Caetrathynnus, Nitidothynnus and *Procerothynnus,* new genera of Thynninae (Hymenoptera: Tiphiidae) from northern Australia

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ABSTRACT

Three new genera are erected to accommodate nine new species of thynnine wasps: *Caetrathynnus* for *C. greggi* sp. nov. (type species). *C. galbinus* sp. nov. and *C. wesselensis* sp. nov.; *Nitidothynnus* for *N. purdiei* sp. nov. (type species), *N. ebeneus* sp. nov. and *N. spinulus* sp. nov.; and *Procerothynnus* for *P. centralianus* sp. nov. (type species), *P. arnhemicus* sp. nov. and *P. carpentarianus* sp. nov. All the new species are described from males only, except *Nitidothynnus spinulus* and *N. purdiei,* which are known from both males and females. Keys to species are given, as is a discussion of coupling mechanisms in *Nitidothynnus* and the phenomenon of mixed species couples is considered in light of the biology of the subfamily. Most of the new species are recorded only from the Top End of the Northern Territory, although *Caetrathynnus galbinus* also occurs in adjacent areas of northern Western Australia and *Procerothynnus carpentarianus* also occurs in adjacent areas of north-western Queensland. *Procerothynnus centralianus* is recorded from central Australia while *Nitidothynnus ebeneus* is known only from the holotype from northern Queensland.

KEYWORDS. Tiphiidae, Thynninae, new genera, *Caetrathynnus, Chilothynnus, Nitidothynnus, Procerothynnus, Aspidothynnus*, Australia, taxonomy, biogeography.

INTRODUCTION

Wasps of the subfamily Thynninae comprise a very diverse group in Australia which includes many undescribed species and genera (Brown 1998a). Some 600 species have been described, mostly from the vicinity of the large coastal cities in eastern, south-eastern and south-western mainland Australia (Given 1954; Salter 1954). Very few have been described from northern or inland Australia, and there are only 26 known from the Northern Territory.

Adults are most commonly observed feeding on flowers (hence the common name "flower wasps") where they often occur in copula. The main food source appears to be nectar, although other plant and insect secretions and exudates are also eaten (Tillyard 1926; Burrell 1935). Nectar from flowers of the plant family Myrtaceae, which includes eucalypts and tea trees, is particularly attractive, and may attract these wasps in large numbers at the height of the flowering season.

Male thynnines are fully-winged, while females are smaller, wingless, and somewhat ant-like in appearance. Because females are wingless, and cannot therefore travel very far by themselves, they are dependant on males for food. Feeding occurs during mating as pairs couple for long periods during which the male carries the female to flowers. Pairs remain coupled while both are feeding, and there are morphological structures present that assist pairs to remain coupled for prolonged periods. Since the sexes are so different morphologically, it is the convention to describe each separately. Unfortunately in the descriptions that follow this is not possible for every species because of the lack of females.

Females produce pheromones to attract males prior to mating. However, on rare occasions when a conspecific male never arrives, a female may couple with a non-conspecific male (Brown 1993). This is a common occurrence in this subfamily and is most probably a mechanism that ensures a hungry female is carried to a food source at the expense of successful mating. The latter may be of little concern to the survival of the species as a whole because unfertilised females of all Hymenoptera (ants, bees and wasps) produce male offspring which are haploid anyway (Naumann 1991). This phenomenon of miscoupling is mentioned specifically under the descriptions of *Nitidothynnus purdiei* and *N. spinulus* in this paper.

The Thynninae has not been revised taxonomically since 1910 (Turner 1910) and the only critical examinations since then have been revisions for the

genera *Acanthothynnus* Turner, *Doratithynnus* Turner, *Encopothynnus* Turner and *Macrothynnus* Turner (Brown 1987, 1989a, 1989b, 1995a). These revisions indicated that, in at least these genera, between 50% and 75% of the fauna currently represented in collections was undescribed and that many species were known from only one or two specimens. This suggests that more extensive collecting, especially in more remote areas such as the Northern Territory of Australia, will reveal even more new species.

Currently there are 37 genera considered to be valid within the tribe Thynnini in Australia (Given 1954; Brown 1983, 1992, 1995b, 1997a, 1997b, 1998b). Studies by the present author indicate that these genera form three distinct clusters. The first cluster contains the genera *Bifidothynnus* Brown, *Campylothynnus* Turner, *Catocheilus* Guérin, *Elidothynnus* Turner, *Guerinius* Ashmead, *Leptothynnus* Turner, *Lestricothynnus* Turner, *Lophocheilus* Guérin, *Macrothynnus* Turner, *Megalothynnus* Turner, *Oncorhinothynnus* Salter, *Pogonothynnus* Turner, *Thynnoides* Guérin, *Thynnus* Fabricius and *Zaspilothynnus* Ashmead. It is distinguished from the other two generic clusters by numerous characters including the labrum weakly rather than strongly narrowed basally, the propodeum oblique in profile, tergite 7 longitudinally multicarinate (except in *Bifidothynnus* and *Guerinius* which have tergite 7 otherwise modified) and sternite 8 with prominent basal angles or spines in the male, and sternite 5 rugose and/or carinate in the female. Most Australasian species are also larger in size than those found in the other two clusters.

The second cluster includes *Acanthothynnus* Turner, *Arthrothynnus* Brown, *Aspidothynnus* Turner, *Doratithynnus* Turner, *Encopothynnus* Turner, *Epactiothynnus* Turner, *Gymnothynnus* Turner, *Iswaroides* Ashmead and *Tmesothynnus* Turner. It differs from the subsequent cluster by having most metasomal segments strongly constricted (and sometimes spinose), and tergite 7 with a strong transverse apical carina.

The third generic cluster includes *Aeolothynnus* Ashmead, *Agriomyia* Guérin, *Ariphron* Erichson, *Chilothynnus* Brown, *Leiothynnus* Turner, *Neozeleboria* Rohwer, *Pentazeleboria* Brown, *Phymatothynnus* Turner, *Psammothynnus* Ashmead, *Tachynoides* Kimsey, *Tachynomyia* Guérin, *Tachyphron* Brown, and *Zeleboria* Saussure. This cluster is distinguished from other Australian Thynnini (and Thynninae) by the combination of: a relatively short, weakly protruding sternite 8 that is not broadened into lobes or spines at the base, and which may be armed apically with a narrow spine (with or without lateral spines); the metasomal segments are not strongly constricted or heavily sclerotized; a convex tergite 7 that is uniformly punctate with a medial impunctate area, but without a transversely carinate apical margin; and the basiparameres are not strongly developed ventrobasally such that the ventrobasal angle (in profile) is well separated from the basal ring. A key to genera in this cluster was given by Brown (1998a), although *Tachynoides* was omitted. That genus keys to *Tachyphron* in that key.

The three new genera described here belong to the third cluster. Two of these were included in the key to genera by Brown (1998a) and referred to as genus A and genus B.

Terminology follows Snodgrass (1941), Brown (1997a,b) and Naumann (1991). Relative terms relating to microsculpture are interpreted as follows: sparsely punctate = punctures greater than two puncture-diameters apart; punctate = punctures at most two puncture-diameters apart, but never confluent; closely punctate = punctures almost confluent; rugosely punctate = punctures partially confluent; finely punctate = punctures small and shallow; coarsely punctate = punctures large and deep; obscurely punctate = punctures small, sparse, shallow and only visible at certain angles.

Abbreviations. Morphological characters: T1-7, metasomal tergites 1-7; S1-8, metasomal sternites 1-8; POL:OOL, ratio of distance between posterior ocelli to distance between eye and posterior ocellus. Specimen repositories: AM, Australian Museum, Sydney; ANIC, Australian National Insect Collection, CSIRO, Canberra; BMNH, The Natural History Museum, London; MV, Museum of Victoria, Melbourne; NTM, Museum and Art Gallery of the Northern Territory, Darwin; OTTAWA, Agriculture Canada, Ontario; QM, Queensland Museum, Brisbane; SAM, South Australian Museum, Adelaide; UQIC, University of Queensland, Brisbane; WAM, Western Australian Museum, Perth.

SYSTEMATICS

Caetrathynnus gen. nov.

Type species. Here designated *Caetrathynnus greggi* sp. nov.

Generic diagnosis. *Male.* Head, mesosoma and metasoma strongly polished with metasoma shagreened. Mandibles long, narrow and straight. Clypeus convex, strongly produced and broadly truncate apically. Antennal prominence long, narrowly U-shaped with margins slightly emarginate dorsally, sagittally sulcate, and with short oblique carina above antennal insertions. Frons strongly and broadly depressed lateral to antennal prominence. Antennae short and only just reaching propodeum, apical 6 segments weakly arcuate. Pronotum with anterior margin weakly raised not carinate, lateral margins strongly convergent anteriorly. Mid femur strongly and abruptly broadened at base. Metasoma

fusiform, segment 1 subpetiolate, about as wide as long; segments 3-4 widest, segments (apart from T2 and S2 anteriorly) not constricted. T7 convex, slightly produced and membranous apically, not transversely apical carinate. S8 subtriangular with a single narrow slightly upturned apical spine, narrowly emarginate at base of spine. Genitalia with basal ring cylindrical, not short; basiparameres suborbicular to subtriangular (viewed dorsally), not apically emarginate; parameres subparallel, of moderate length and width, apex subtruncate; cuspides of moderate length with opposing digitate digitus apically.

Remarks. *Caetrathynnus* is most readily distinguished from other thynnine genera (in particular, those of the third cluster) by the structure of the mandibles which are long, narrow and straight, and the clypeus which is broadly convex without a sagittal carina, and with the apical margin strongly produced and broadly truncate. The broadly convex and broadly apically truncate clypeus suggests a relationship with *Psammothynnus* and *Zeleboria*. However, in both of these genera, the mandible is shorter, broader and curved (as normally found in other genera) and the clypeus is shorter, more strongly convex and sagittally carinate. These differences in clypeal shape suggest that an enlarged clypeus may have arisen in *Caetrathynnus* independently to that of *Psammothynnus* and *Zeleboria,* and is supported by differences in the genitalia which differ from *Caetrathynnus* by having the basal ring very short, the fused basiparameres truncate to emarginate dorsoapically and, in many species, the parameres with a ventroapical lobe. These two genera also lack a single medial spine on S8 which occurs in *Caetrathynnus* and many other Thynninae.

Caetrathynnus superficially resembles *Aspidothynnus* Turner in that: the clypeus is broadly convex, and strongly and broadly produced apically without a sagittal carina; and the metasoma is fusiform without spines on the tergites or sternites. However, *Aspidothynnus* belongs to the second generic cluster and as such differs by those characters as listed in the Introduction. *Aspidothynnus* also differs from *Caetrathynnus* by having the antennal prominence weakly developed rather than long, narrowly U-shaped with margins slightly emarginate dorsally; T1 wider than long rather than as approximately as wide as long; and metasomal segments with spots rather than lunulate marks.

The three species of *Caetrathynnus* are very similar in appearance, but differ slightly in the punctation of clypeus, gena and pronotum, and the shape of the fore coxae, the depth of the anterior depression on S2 (typical of all Thynninae), the base of the apical spine of S8, and the genitalia. They are reliably distinguished by the genitalia.

All three are recorded from the north of the Northern Territory. *Caetrathynnus galbinus* sp. nov. is recorded from near the Western Australian border while *C. wesselensis* sp. nov. is known only from the holotype from the Wessel Islands. *C. greggi* sp. nov. is the most widely occurring species, and it ranges from Darwin to Borroloola.

Caetrathynnus was referred to as genus "A" by Brown (1998a) in a key to closely related genera.

Etymology. The generic name is masculine and is derived from the Latin word *caetra* (also spelt *cetra*) which is a type of shield. It is a reference to the shape of the male clypeus.

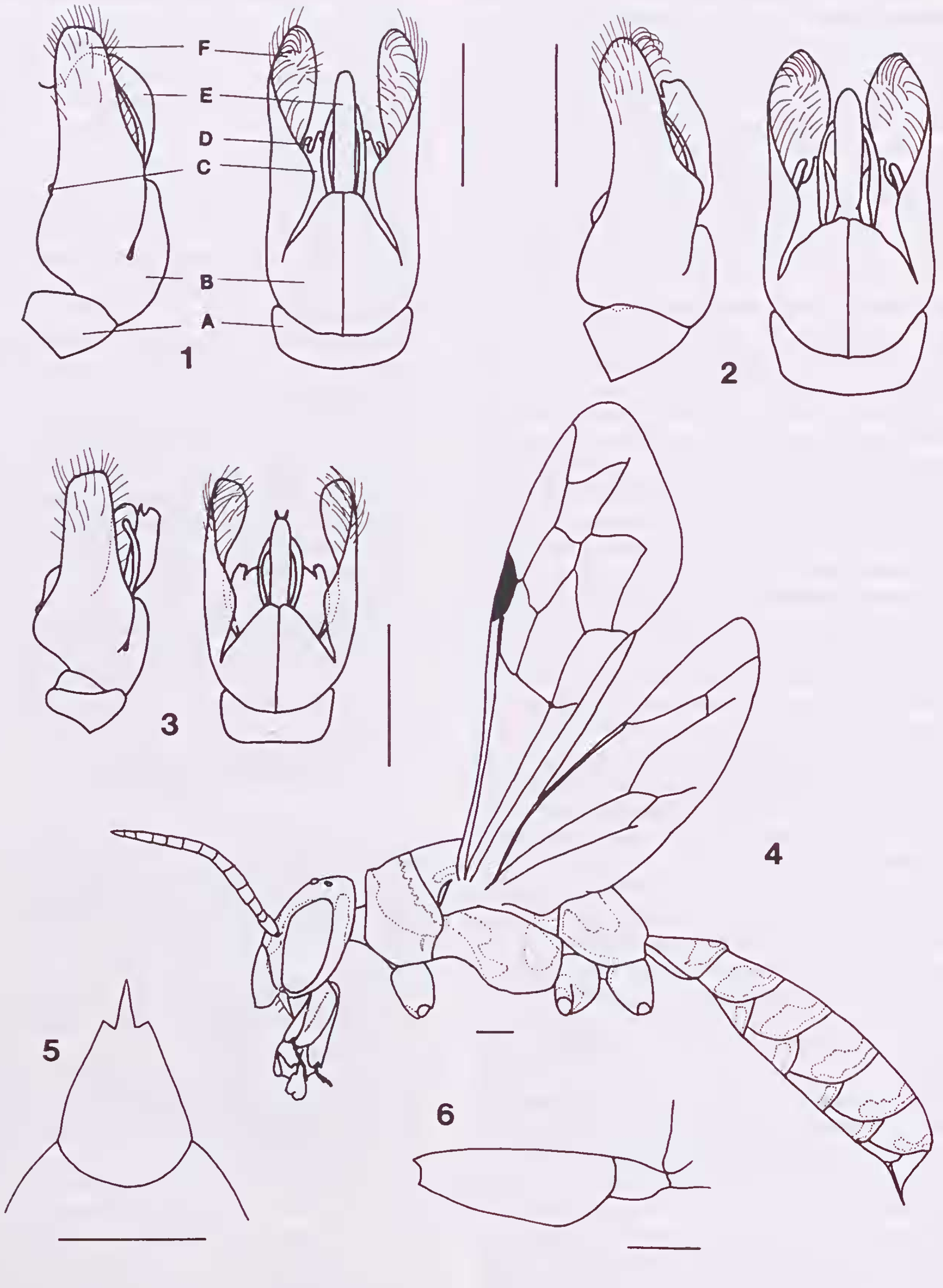
Key to males of *Caetrathynnus*. (Females are unknown.)

1. a Most sclerites predominantly yellow; prosterna black with yellow spot; propodeum with U-shaped lateral marks at least partially fused medially .... *C. galbinus* sp. nov.
   b Sclerites predominantly black (may have extensive yellow marks but not distinctively more yellow than black); prosterna black without yellow spot; propodeum with U-shaped lateral marks not fused medially 2
2. a Apex of parameres truncate (Fig. 3); base of cuspis sinusoidal (in profile) .... *C. wesselensis* sp. nov.
   b Apex of parameres rounded (Fig. 2); base of cuspis rounded (in profile) .... *C. greggi* sp. nov.

Caetrathynnus galbinus sp. nov.
(Fig. 1)

Type material. HOLOTYPE ♂ - NTM (1911): Keep River NP, Garrandalng, 15°53'S, 129°03'E, Northern Territory, 30 April 1996, G.R. Brown. PARATYPES - *Western Australia*: UQIC (3♂), 14 mi. (22.5 km) S of Kununurra, on *Eucalyptus ?pruinosa*, 5 March 1973, E.M. Exley.

Description of male. Body length 11 mm; fore wing 8 mm; hind wing 6 mm. Clypeus rugosely punctate, punctures shallow and vertically aligned, apical margin width to maximum width 1:2.0. POL:OOL 1:1.1. Frons closely and shallowly punctate. Vertex obscurely punctate. Gena shallowly and closely punctate. Pronotum sparsely and shallowly punctate, punctures more distinct posterolaterally. Mesoscutum and mesoscutellum sparsely punctate medially, closely punctate laterally. Metanotum punctate. Propodeum closely and shallowly punctate, punctures deeper laterally, impunctate anteriorly. Mesopleura closely to finely punctate. Fore coxae flat. T1 width to length 1:0.9. T2 weakly depressed anteriorly. Tergites and sternites closely and very shallowly punctate such that most tergites and anterior sternites almost appear impunctate, punctures coarser on posterior tergites. S1 not medially raised. S2 strongly



Figs 1-6. *Caetrathynnus* spp., males: **1,** *C. galbinus* sp. nov., genitalia, lateral and dorsal; **2,** *C. greggi* sp. nov., genitalia, lateral and dorsal; **3,** *C. wesselensis* sp. nov., genitalia, lateral and dorsal; **4,** *C. greggi* sp. nov., habitus; **5,** *C. greggi* sp. nov., S8; **6,** *C. greggi* sp. nov., right mid trochanter and femur. **A,** basal ring; **B,** basiparameres; **C,** cuspis; **D,** digitus; **E,** aedeagus; **F,** paramere. Scale lines = 0.5 mm.

depressed anteriorly. S8 slightly emarginate at base of spine. Genitalia as in Figure 1: basiparameres subtriangular (viewed dorsally) with each basiparamere truncate apically; parameres relatively short, subtruncate apically, weakly dorsally lobed (in profile) near base of aedeagus; cuspis subparallel basally, apically triangular, apex ending slightly beyond apex of digitus and outwardly curved, base rounded and slightly visible in profile.

Colour. Black; yellow colouration as follows: mandibles (except apex), stipes, clypeus (except obscure medial anchor-shaped mark), large longitudinal mark (except very narrow sagittal line) above antennal insertion, inner and outer orbits of eyes with outer orbit almost continuous with inner orbits and extending discontinuously across vertex, anterior margin of pronotum broadly (very narrowly discontinuous medially), posterior margin of pronotum broadly, tegulae, mesoscutum with large spot on disc and horizontal mark above fore wing, large spot on disc of mesoscutellum, axillae, metanotum, metapleuron, broad lateral U-shaped mark on propodeum, mesopleura (except mesopleural groove), spot on prosterna, margins of mesosternal lamellae, coxae (except base of mid and hind coxae), outer surfaces of trochanters, femora and fore tibiae, dorsal surface of fore femora, T1-6 (except anteromedially and posterolateral spot), sagittal line on S1, S2 (except anteromedial and posterolateral spots), curved lateral mark on posterior margin of S3-6 (almost confluent medially); orange colouration as follows: legs (except coxae outer surfaces of trochanters, femora and fore tibiae, dorsal surface of fore femora). Margin of tegulae semitransparent. Wing membranes hyaline with veins orange to brown. Setae white.

Distribution. Known only from the Northern Territory-Western Australian border near Kununurra.

Remarks. This species is distinguished from other species of *Caetrathynnus* by the extent of the yellow colouration such that most sclerites are predominantly yellow, including the presence of a spot on the prosterna, and enlarged U-shaped lateral markings on the propodeum which are at least partially fused medially. It is also distinguished by having the fore coxae flat, the clypeus with punctures vertically aligned, and the pronotum with punctures most distinct posterolaterally.

Yellow colouration may be expanded on the clypeus, and on the propodeum so that marks are confluent medially, or slightly reduced on the pronotum, propodeum and metasoma. Black on the metasoma may be partially replaced by brown, or it may be expanded such that it is confluent with the black posterolateral spots on some segments.

Etymology. The specific name is derived from the Latin word *galbinus* (= yellowish) and it refers to the extensive yellow colouration of the male.

Caetrathynnus greggi sp. nov.

(Figs 2, 4-6)

Type material. HOLOTYPE ♂ - NTM (I895): 17 Mile, Virginia, 12°33'S, 131°02'E, near Darwin, Northern Territory, 28 April 1996, S. Gregg. PARATYPES - *Northern Territory*: AM (K122050), BMNH (E2000-27), MV (T17352), NTM (I896-I898), QM (T57838), SAM (I 21437), WAM (26555) (9♂), same data as holotype (3 NTM, 1 AM), 4 May 1996 (1 BMNH, 1 MV), 19 May 1996 (1 QM, 1 SAM), December 1997 (1 WAM); NTM (I899-I901) (3♂), Arafura Swamp, 12°16'S, 124°59'E, 9 June 1996, G.R. Brown; NTM (I902-I903), OTTAWA (3♂), Berry Springs 50 km S Darwin, rainforest, Malaise trap, 4-27 December 1993, S. and J. Peck; ANIC (1♂), 12 km NNE of Borroloola, 15°58'S, 136°21'E, 1 November 1975, J.C. Cardale; NTM (I904) (1♂), McMillans Rd [Berrimah] near Darwin, eucalyptus woodland, Malaise trap, 1-25 December 1993, S. and J. Peck; NTM (I905), OTTAWA (2♂), Berrimah near Darwin, mixed eucalyptus woodland, 25 December 1993-10 January 1994, S. and J. Peck; NTM (I906) (1♂), Mindil Beach near Darwin, 13 May 1996, S. Gregg; NTM (I907) (1♂), Melville I., swamp W of Taracumbi Falls, 11°35'S, 130°40'E, 4 October 1996, G.R. Brown and G. Dally; NTM (I908) (1♂), Melville I., Mirikau-Yunga Ck, 11°31'S, 130°41'E, 5 October 1996, G.R. Brown and G. Dally; NTM (I909) (1♂), Melville I., 11°35'S, 130°40'E, Malaise trap, 4-15 October 1996, G.R. Brown; NTM (I910) (1♂), Mt Mortgage, Humpty Doo, 12°35'S, 131°05'E, 28 February-31 March 1992, A. Wells and J. Webber; ANIC (1♂), 19 km NE of Mt Cahill, 12°47'S, 132°51'E, 16 November 1972, J.C. Cardale.

Description of male. Body length 8-12 mm; fore wing 6-9 mm; hind wing 4.5-6 mm. Clypeus rugosely and shallowly punctate, apical margin width to maximum width 1:1.6. POL:OOL 1:0.9. Frons closely and shallowly punctate. Vertex obscurely punctate. Gena shallowly and closely to rugosely punctate. Pronotum sparsely and shallowly punctate, punctures more distinct on anterior and posterior margins. Mesoscutum and mesoscutellum sparsely punctate medially, closely punctate laterally. Metanotum punctate. Propodeum closely and shallowly punctate, punctures deeper laterally, impunctate anteriorly. Mesopleura closely to finely punctate. Fore coxae almost flat. T1 width to length 1:1.0. T2 weakly depressed anteriorly. Tergites and sternites closely and very shallowly punctate such that most tergites and anterior sternites almost appear impunctate, punctures coarser on posterior tergites. S1 not medially raised. S2 depressed anteriorly. S8 emarginate at base of spine. Genitalia as in Figure 2: basiparameres broadly subtriangular (viewed dorsally) with each basiparamere rounded apically; parameres relatively long, rounded apically, distinctly dorsally

lobed (in profile) near base of aedeagus; cuspis subparallel basally, apically triangular, apex ending slightly beyond apex of digitus and outwardly curved, base rounded and strongly visible in profile.

Colour. Black; yellow colouration as follows: mandibles (except apex), clypeus (except medial anchor-shaped mark), large longitudinal mark (except very narrow sagittal line) above antennal insertion, inner and outer orbits of eyes almost continuous dorsally, transverse line behind ocelli, margins of pronotum (anterior margin very narrowly discontinuous medially, and expanded ventrally), tegulae, mesoscutum with large spot on disc and horizontal mark above fore wing, central and anterolateral spots on mesoscutellum, axillae, disc and anterolateral spot on metanotum, metapleuron, broad lateral U-shaped mark on propodeum, anterior vertical mark and small mark and adjacent spot near mid coxa on mesopleura, margins of mesosternal lamellae, coxae (except bases), extreme apices of femora, dorsal line on fore femora, ventral margin of mid and hind femora, lunulate lateral line on posterior margin of T1-6 and S3-5 usually or virtually contiguous medially; orange colouration as follows: legs (except coxae, apex of fore trochanter, extreme apices of femora, dorsal line on fore femora, ventral margin of mid and hind femora). Margin of tegulae semitransparent. Wing membranes hyaline with veins orange to dark brown. Setae white.

Distribution. Coastal Northern Territory from Darwin to Borroloola.

Remarks. This species is distinguished from *Caetrathynnus galbinus* by having less extensive yellow colouration such that most sclerites are predonimantly black. It is distinguished from *C. wesselensis* sp. nov. by having the apex of the parameres rounded and the base of the cuspis rounded in profile. It is distinguished from both species by having S8 more emarginate at the base of the apical spine, the gena with punctation more rugose, and the pronotum with punctation more distinct on the anterior and posterior margins.

The yellow colouration may be expanded on the tergites to enclose a posterolateral spot, or reduced on the mesoscutum and mesoscutellum such that the medial spots are elongate marks. Black colouration on the trochanters may be replaced by orange.

Etymology. This species is named after Steven Gregg of the Museum and Art Gallery of the Northern Territory who collected many of the type series, and who has a great love of natural history.

Caetrathynnus wesselensis sp. nov.

(Fig. 3)

Type material. HOLOTYPE ♂ - ANIC : 11°01'S, 136°45'E, Rimbija Is., Wessel Islands, Northern Territory, 3-14 February 1977, T.A. Weir.

Description of male. Body length 7 mm; fore wing 6 mm; hind wing 4 mm. Clypeus rugosely and shallowly punctate, apical margin width to maximum width 1:1.8. POL:OOL 1:0.9. Frons closely and shallowly punctate. Vertex obscurely punctate. Gena shallowly and closely punctate. Pronotum sparsely and shallowly punctate, punctures more distinct posterolaterally and ventrally. Mesoscutum and mesoscutellum sparsely punctate medially, closely punctate laterally. Metanotum punctate. Propodeum closely and shallowly punctate, punctures deeper laterally, impunctate anteriorly. Mesopleura closely to finely punctate. Fore coxae slightly convex. T1 width to length 1:1.2. T2 weakly depressed anteriorly. Tergites and sternites closely and very shallowly punctate such that most tergites and anterior sternites almost appear impunctate, punctures coarser on posterior tergites. S1 not medially raised. S2 depressed anteriorly. S8 slightly emarginate at base of spine. Genitalia as in Figure 3: basiparameres subtriangular (viewed dorsally) with each basiparamere rounded apically; parameres relatively short, distinctly truncate apically, weakly dorsally lobed (in profile) near base of aedeagus; cuspis subparallel basally, apically triangular, apex ending slightly before apex of digitus and not outwardly curved, base sinuate and strongly visible in profile.

Colour. Black; yellow colouration as follows: mandibles (except apex), clypeus (except obscure medial anchor-shaped mark), large longitudinal mark (except very narrow sagittal line) above antennal insertion, inner and outer orbits of eyes almost continuous dorsally, margins of pronotum (anterior margin narrowly discontinuous medially, and expanded and confluent ventrally), tegulae, mesoscutum with spot on disc and horizontal mark above fore wing, central and antero-lateral spots on mesoscutellum, axillae, disc and anterolateral spot on metanotum, spot on metapleuron, lateral U-shaped mark on propodeum, anterior vertical mark and small mark and adjacent spot near mid coxa on mesopleura, margins of mesosternal lamellae, apex of fore coxae, mark on inner and outer margins of mid and hind coxae apically, ventral surfaces and dorsal mark apical mark on femora, lunulate lateral line on posterior margin of T1-6 and S2-5 contiguous medially on tergites; orange colouration as follows: legs (except coxae, apex of fore trochanters, mid and hind trochanters, ventral surfaces and dorsal mark apical mark on femora). Margin of tegulae semitransparent. Wing membranes hyaline with veins orange to brown. Setae white.

Distribution. Only known from a single specimen from Rimbija I., Wessel Islands off the coast of Arnhem Land, Northern Territory.

Remarks. This species is distinguished from other species of *Caetrathynnus* by the apically truncate parameres and the straight lateral margins of the basiparameres. It also differs from *C. greggi* which has the base of the cuspis rounded rather than sinusoidal in profile and from *C. galbinus* which has more extensive

yellow colouration such that the sclerites are more yellow than black including a yellow spot on the prosterna and the yellow U-shaped lateral marks on the propodeum fused medially. This species is also distinguished by the punctures on the pronotum being most distinct postero-laterally and ventrally, and the fore coxae which are slightly convex.

This species is similar in colouration to *C. greggi*.

Etymology. The species name is derived from the type locality.

Nitidothynnus gen. nov.

Type species. Here designated *Nitidothynnus purdiei* sp. nov.

Generic diagnosis. *Male.* Head, mesosoma and metasoma (especially dorsally) strongly polished and mostly obscurely punctate (such that punctures are sparse, and very small and shallow giving the appearance of the integument being impunctate especially on the vertex and pronotum). Clypeus convex basomedially, not carinate, narrowly truncate. Antennal prominence double U-shaped, medially sulcate, above plane of clypeus. Antennae long, longer than combined length of head and mesosoma, flagellar (except basal) segments four times longer than wide, apical six segments weakly arcuate. Maxillary palps with apical 3 segments each longer than basal 3 segments, fourth segment longest. Pronotum with lateral margins strongly convergent anteriorly, anterior margin raised but not carinate, anterior truncation transversely carinate ventrally and produced laterally such that the pronotum is produced anterolaterally. Mesopleura with longitudinal median groove ventrally. Fore trochanters long and strongly narrowed over most of length from base. Metasoma elongate-fusiform, sclerites weakly sclerotized (except S1 and S8) and at most slightly constricted (although more so basally on S3-5 and especially S2 and T2). T7 convex, becoming slightly produced and membranous apically, not carinate. S8 with lateral margins curved, trispinose with medial spine longest. Genitalia with basal ring of medium length, subcylindrical and (in profile) slightly curved; basiparameres subovate (viewed dorsally) and emarginate medially, apices of individual basiparameres produced and often acute; parameres long and narrow especially apically, curved and convergent apically. All species are extensively marked with yellow on a reddish orange background although most of the reddish orange is replaced with black on the meso- and metathorax in some specimens.

Female. Mandible unidentate. Clypeus narrowly truncate to slightly emarginate, medially raised. Frons obscurely sagittally sulcate. Pronotum wider than long, anterior margin clearly defined, longer than posterior margin, anterolateral angles spinose, lateral margins carinate on posterior half ending in a small tooth anteriorly; disc slightly medially raised, raised area wider posteriorly. Mesoscutellum narrow. Mesopleura with slight dorsal surface. Propodeum projecting well above level of mesoscutellum, oblique posteriorly becoming flattened dorsally, apex directed anteriorly and narrowed. Fore femur concave on apical half of ventral surface. T1 vertically truncate and setose anteriorly; dorsal surface with carinate apical margin and curved impressed preapical line. T2 impunctate with three to five transverse carinae. T3-5 with impressed curved preapical line. Pygidium (T6) curved in profile, posterior surface long and narrow with carinate lateral margins, ventral margins narrowly rounded, slightly emarginate laterally. Sternites sparsely and shallowly punctate.

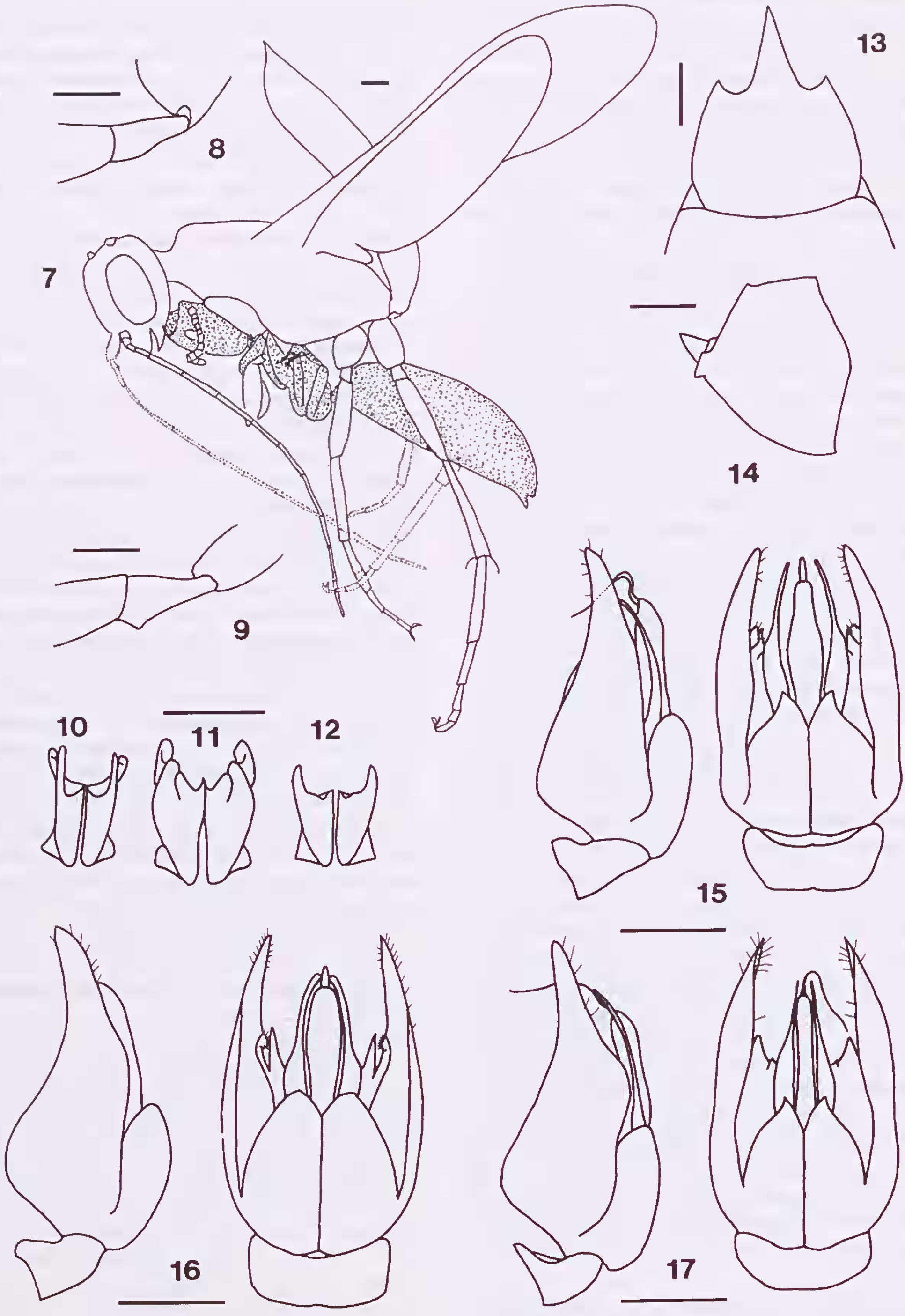
Remarks. The genus *Nitidothynnus* is most readily distinguished from other genera of the generic cluster by the microsculpture of the head, mesosoma and metasoma which are distinctively polished and obscurely punctate (particularly diagnostic on the vertex and pronotum); the anterior truncated surface of the pronotum transversely carinate ventrally and produced laterally and visible laterally as a short truncated process; the antennae relatively long; and the fore trochanters long and strongly narrowed over most of their length from the base. A convex, non-carinate clypeus that is below the plane of the antennal prominence, and long apical maxillary palp segments are similar to these states in *Neozeleboria*. However, *Neozeleboria* has S8 subparallel to sub-triangular with the apex ranging from rounded to slightly emarginate but with only a single apical spine rather than with lateral margins curved with the apex trispinose.

Antennae are characteristically long in *Nitidothynnus* with antennae longer than the combined length of the head and mesosoma, and most flagellar segments four times longer than wide. In most other genera of the generic cluster (except some species of *Tachynomyia* and closely related genera) they are shorter but distinctly longer than wide. This compares to the short antennae found in *Procerothynnus* in which the antennal segments are only slightly longer than wide, appearing virtually as long as wide.

The three species placed in this genus are very similar in appearance and are also best separated by the male genitalia, although *Nitidothynnus spinulus* is distinguished by the presence of a preapical spine on the fore and hind trochanters. Only the females of *N. purdiei* and *N. spinulus* are known, and these are distinguished by the shape of the head and T6. Both species are widespread in the Top End of the Northern Territory, and have overlapping distributions, while *N. ebeneus* is only known from the holotype from north-eastern Queensland.

Nitidothynnus was referred to as genus "B" by Brown (1998a) in a key to closely related genera.

Etymology. The generic name is masculine and is derived from the Latin word *nitidus* (= shining), and is a reference to the shining head, mesosoma and metasoma of the male.



Figs 7-17. *Nitidothynnus* spp., males: **7,** *N. spinulus* sp. nov., male carrying female (female except eye and antenna stippled); **8,** *N. purdiei* sp. nov., fore trochanter; **9,** *N. spinulus* sp. nov., fore trochanter; **10,** *N. purdiei* sp. nov., cuspis, ventral; **11,** *N. spinulus* sp. nov., cuspis, ventral; **12,** *N. ebeneus* sp. nov., cuspis, ventral; **13,** *N. spinulus* sp. nov., S8; **14,** *N. spinulus* sp. nov., prothorax lateral; **15,** *N. spinulus* sp. nov., genitalia, lateral and dorsal; **16,** *N. purdiei* sp. nov., genitalia, lateral and dorsal; **17,** *N. ebeneus* sp. nov., genitalia, lateral and dorsal. Scale lines = 0.25 mm.

Key to species of *Nitidothynnus*. (The female of *N. ebeneus* is unknown)

1. a Male (winged) 2
   b Female (wingless) 4
2. a Fore and hind trochanters with preapical spine on ventral margin (most conspicuous if viewed posteriorly) (Fig. 9) .... *N. spinulus* sp. nov.
   b Trochanters without preapical spine on ventral margin (Fig. 8) 3
3. a Genitalia (viewed dorsally) with each basiparamere with outer margin curved and ending in an obtuse point (Fig. 16) and cuspis (Fig. 10) with ventral surface mostly horizontal becoming abruptly and strongly concave apically (excluding lamellate projection) .... *N. purdiei* sp. nov.
   b Genitalia (viewed dorsally) with each basiparamere with outer margin sinusoidal and ending in an acute point (Fig. 17) and cuspis (Fig. 12) with ventral surface almost flat and sloping upwards towards apex, not abruptly truncated or concave apically (excluding lamellate projection) ....*N. ebeneus* sp. nov.
4. a Head with posterolateral angles emarginate (Fig. 20); T6 subparallel dorsally (Fig. 23) .... *N. spinulus* sp. nov.
   b Head with posterolateral angles rounded (Fig. 21); T6 broadened ventroapically(Fig. 22) .... *N. purdiei* sp. nov.

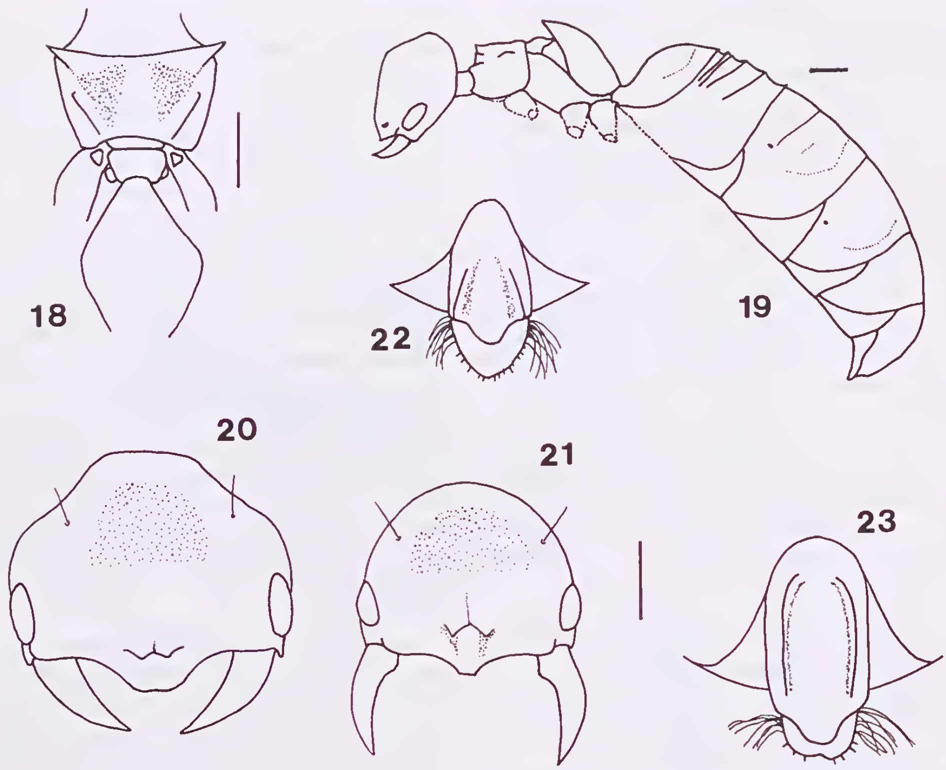
Nitidothynnus purdiei sp. nov.
(Figs 8, 10, 16, 21-22)

Type material. HOLOTYPE♂ - NTM (I912): near Oenpelli reservoir, campsite, 12°23'S, 133°05'E, 27 November 1997, G.R. Brown and J.E. Purdie. PARATYPES - *Northern Territory*: NTM (I913-I916) (4♂), same data as holotype; NTM (I917) (1♂), below Oenpelli reservoir, 12°24'S, 133°05'E, 27 November 1996, G.R. Brown and J.E. Purdie; NTM (I918) (1♂), near Oenpelli reservoir, by sweeping, 12°22'S, 133°04'E, 27 November 1996, G.R. Brown and J.E. Purdie; BMNH (E2000-27), QM (57840), NTM (I919-I920) (4♂), near Oenpelli, *Allosyncarpia* forest, 12°23'S, 133°01'E, 28 November 1996, G.R. Brown and J.E. Purdie; NTM (I921) (1♂), near Oenpelli, *Allosyncarpia* forest track, 12°23'S, 133°02'E, 30 November 1996, G.R. Brown and J.E. Purdie; NTM (I922) (1♂), Oenpelli reservoir, 12°24'S, 133°05'E, 26 November 1997, G.R. Brown and J.E. Purdie; NTM (I923-I924) (2♂), Daly River rd, Adelaide R. crossing, 13°29'S, 131°06'E, 24 October 1996, G.R. Brown; NTM (I925-I926) (2♂), Blackfellow Ck, Daly River rd, 13°32'S, 130°49'E, 19 November 1997, G.R. Brown; NTM (I927) (1♂), Groote Eylandt, in pit fall trap in open forest, 17-23 June 1982, J. Majer; NTM (I928) (1♂), near Drovers Rest, Litchfield NP, 25 November 1993, G.R. Brown; NTM (I929) (1♂), Maningrida, rubbish tip rd, 12°06'S, 134°13'E, 13 June 1996, G.R. Brown; NTM (I930) (1♂), Mataranka, by sweeping, 1 January 1996, G.R. Brown; NTM (I931) (1♂), 18°37'S, 137°59'E, Border Waterhole near Musselbrook Reserve, 10-17 April 1995, G.R. Brown; NTM (I932) (1♂), UDP Falls, 18-19 July 1980, M.B. Malipatil. NTM (I1166) (1♀) Virginia near Darwin, 12°33'S, 131°02'E, 28 October 1996, S.M. Gregg (mounted with male paratype of *N. spinulus*). *Queensland*: NTM I933-I937 (5♂), Musselbrook Reserve near Musselbrook Ck, 18°33'S, 138°11'E, 18 April 1995, G.R. Brown; ANIC (1♂), Holts Ck, 18°33'S, 138.11'E. 15 May 1995, at light, I.D. Naumann.

Other material. *Northern Territory*: NTM (2♂), near Oenpelli reservoir, by sweeping, 12°22'S, 133°04'E, 27 November 1996, G.R. Brown and J.E. Purdie; NTM (9♂), near Oenpelli reservoir, *Allosyncarpia* forest, 12°23'S, 133°02'E, 28 November 1996, 30 November 1996, G.R. Brown and J.E. Purdie; NTM (1♂), Oenpelli area, November 1996, G.R. Brown and J.E. Purdie. *Queensland*: NTM (4♂), Musselbrook Reserve near Musselbrook Ck, 18°33'S, 138°11'E, 18 April 1995, G.R. Brown.

Description of male. Body length 4.5-8 mm; fore wing 4-7 mm; hind wing 2.5-4 mm. Clypeus shallowly and closely punctate, apical margin width to maximum width 1:4.3. POL:OOL 1:1.6. Frons, vertex, gena and pronotum obscurely sparsely punctate. Lateral margins of pronotum sightly curved and convergent anteriorly, anterior truncation with ventral transverse carina almost continuous medially. Mesoscutum closely punctate anteriorly and laterally, punctures more conspicuous than those on head and pronotum. Mesoscutellum and metanotum obscurely sparsely punctate. Propodeum transversely striate, longer than wide, lateral margins parallel-sided anteriorly, dorsal margin in profile evenly rounded down to metasoma. Mesopleura obscurely sparsely punctate. Fore coxae, long, conical, ventral surface flat. Fore trochanter (Fig. 8) not spined. Metasoma almost impunctate, T1 closely punctate, T6-7 and S6-8 with conspicuous setiferous punctures and setae long. T1 width to length 1:1.1. S1 medially raised, rounded in cross-section, T2 weakly and S2 strongly depressed anteriorly, segments 1-5 flattened and wider than high. Genitalia as in Figure 16: apex of each basiparamere rounded dorsoapically; parameres narrow and narrowly subtriangular; cuspis (Fig. 10) lamellate apically, ventral surface mostly horizontal becoming abruptly and strongly concave apically (excluding lamellate projection).

Colour. Reddish orange; yellow colouration as follows: mandibles (except apex), maxillary and labial palps, clypeus (except medial anchor-shaped mark and dorsolateral spots testaceous), antennal prominence, inner orbits of eyes extending to behind vertex, outer orbits sinusoidally extending across vertex and confluent with inner orbits, margins of pronotum (broadly so



Figs 18-23. *Nitidothynnus* spp., females: **18,** *N. spinulus* sp. nov., mesothorax; **19,** *N. spinulus* sp. nov., habitus; **20,** *N. spinulus* sp. nov., head; **21,** *N. purdiei* sp. nov., head; **22,** *N. purdiei* sp. nov., T6; **23,** *N. spinulus* sp. nov., T6. Scale lines = 0.25 mm.

ventrally), tegulae, mesoscutum with curved mark above fore wing and central subrectangular marks, mesoscutellum with anterolateral spot and central broad trident-shaped mark; disc and anterolateral line on metanotum, most of propodeum, mesopleuron (except curved branched medial mark and ventral surface), metapleuron (except extreme margins), coxae (except extreme bases), margins of mesosternal lamellae, apical margins of trochanters and inner surface of fore trochanter, dorsal and ventral margins of femora irregularly expanded on fore leg, outer surface of tibiae, lateral irregular spots on T1-6 and S1-2; black colouration as follows: ocellar triangle, posterior and posteroventral surfaces of head, anterior truncation and neck of pronotum, mesoscutum (except curved mark above fore wing and central subrectangular marks), mesoscutellum laterally and extreme anterior margin, metanotum (except disc and anterolateral line), extreme anterior margin of and pair of posteromedial spots on propodeum, prosterna, mesopleuron ventrally, extreme margins of metapleuron, S1, S8 and base of T1; tarsi brown especially apically. Wing membranes hyaline, veins orangish brown.

Description of female. Body length 3 mm. Head (Fig. 21) rounded, as wide as long, sparsely punctate with large semicircular closely punctate area occupying most of vertex, posterolateral angles strongly emarginate. T2 with 3 transverse carinae, apical 2 strongest, basal 1 may be obscured by T1. Pygidium (T6) with lateral margins slightly diverging ventrally, and slightly medially and triangularly raised (Fig. 22).

Colour. Pale yellowish brown; head (except appendages) greyer.

Distribution. Northern Territory from Daly River south to Mataranka and east to the Queensland border.

Remarks. The male of this species is distinguished from other species of *Nitidothynnus* by the structure of the genitalia which (when viewed dorsally) has each basiparamere with the outer margin curved and ending in an obtuse point (Fig. 16) and cuspis (Fig. 10) with the ventral surface mostly horizontal becoming abruptly and strongly concave apically. The female is distinguished by the structure of the head which has the posterolateral angles rounded (Fig. 21) and T6 broadened ventro-apically (Fig. 22). The only other known female of a species in the genus *Nitidothynnus* has the posterolateral angles of the head emarginate (Fig. 20) and T6 subparallel dorsally (Fig. 23).

The yellow markings may be expanded on the posterior and anterior margins of the pronotum so that

they are confluent each side of the sagittal line, or confluent medially on S1. They may also be narrowly discontinuous medially on the anterior margin of the pronotum, reduced to a central spot on the pronotum or split into 2 spots on the mesopleuron and replaced with reddish orange, or reduced or absent on S1-2 and T1. Much of the reddish orange on the mesoscutum and propodeum may be replaced with black. The apex of the metasoma may be slightly darker.

The Musselbrook Reserve specimens tend to have the mesosoma darker than the majority of the other specimens, but fit within the range of colour variation of these specimens. There are no noticeable differences in the genitalia to justify a separate species for the Musselbrook material.

The specimen from Groote Eylandt is labelled as coming from a pit fall trap. This is unusual, but it is conceivable that a wingless female could have fallen into such a trap, and, once there, attracted the male by pheromones. I have never seen thynnines of either sex in pit fall traps, although the wingless females of the closely related family Mutillidae ("velvet ants") are frequently caught in such traps.

Etymology. This species is named after John Purdie who collected many of the type series, and who is a keen naturalist and a close friend.

Mating biology. As indicated in the Introduction, mixed species pairs may be encountered occasionally. This is indicated in museum collections when a series consisting of a single species of male includes females of two different species that have both been collected in copula with this species of male. In the absence of morphological structures that may, for example, be adaptations to prolonged coupling, and therefore, associate pairs, sexes may be associated on the assumption that the majority of specimens couple correctly. This is the case with *Nitidothynnus purdiei* and *N. spinulus*.

Females of *Nitidothynnus purdiei* and *N. spinulus* are associated with males on the basis of coincident collecting data for four males and one female of *N. spinulus* from Virginia, and two males and two females *N. spinulus* from Berrimah. The Virginia specimens include a pair collected in copula while the Berrimah females include a pair grasping each other and which had probably been in copula prior to being killed.

The Berrimah pair is interesting in the way the male and female fit closely together. The male is clasping the female with its legs such that: the hind trochanteral spine fits into the groove before the apical carina on T2 of the female; the fore trochanteral spine is holding the fore femur of the female away from her body; and the male head is deflexed so that the female head is held closely between the mouthparts and the fore coxae of the male. The female is clasping the male with her mouthparts and has the fore femur overlapping the fore trochanter and femur of the male, and has the protruding propodeum slotted into the longitudinal ventral groove along suture of the mesopleura of the male.

Contrary to this association of sexes is another female in which the head is rounded posterolaterally and T6 is broadened ventrally. This female was collected in copula at Virginia with a male of *N. spinulus*. The female is believed to be *N. purdiei* as it is the only other species which overlaps in distribution with *N. spinulus* (although there are no other coincident collecting records).

As pairs couple for prolonged periods, there is the possibility that the shape of structures in the two sexes that are juxtaposed as a result of this coupling, may be correlated. The major differences in the shape of the female head, and the juxtaposition of the female head and male fore coxae in Figure 7 suggests that there may be a correlation between these structures that permit the association of sexes on morphological grounds. However, no differences in the structure of the male fore coxae could be found that would explain differences in the female head shape.

Nitidothynnus ebeneus sp. nov.

(Figs 12, 17)

Type material. HOLOTYPE ♂ - QM (T57841): near Granite Gorge, 17°01'S. 145°20'E, 21 May 1989, 12 km SW Mareeba, Queensland, G. and A. Daniels.

Description of male. Body length 7 mm; fore wing 5 mm; hind wing 4 mm. Clypeus with apical margin width to maximum width 1:5.0. POL:OOL 1:1.5. Anterior truncation of pronotum with ventral transverse carina broadly discontinuous medially. Fore trochanter not spined. T1 width to length 1:1.2. Genitalia as in Figure 17: apex of each basiparamere narrow and acute dorsoapically; parameres subtriangular, strongly narrowed beyond level of apex of cuspis; cuspis (Fig. 12) lamellate apically, ventral surface almost flat and sloping upwards towards apex, not abruptly truncated or concave apically (excluding lamellate projection). Otherwise as *N. purdiei*.

Colour. Black; yellow colouration as follows: mandibles (except apex), maxillary and labial palps, clypeus (except testaceous medial anchor-shaped), antennal prominence, inner orbits of eyes extending to behind vertex, outer orbits of eyes sinusoidally extending across vertex and confluent with inner orbits, anterior and posterior margins of pronotum, tegulae, mesoscutum with curved mark above fore wing and central sub-rectangular marks, mesoscutellum with anterolateral spot and central broad inverted T-shaped mark, disc and anterolateral line on metanotum, propodeum with medial line strongly broadened anteriorly and lateral line strongly broadened posteriorly, mesopleuron (except curved branched medial mark and ventral surface), spot on metapleuron, fore and mid coxae (except extreme bases), outer margin of hind coxa, margins of mesosternal

lamellae, apical margins of trochanters, dorsal and ventral margins of femora, outer surface of tibiae, lateral irregular spots on T1-5; reddish orange colouration as follows: gena and vertex dorsally, legs (except coxa and yellow marks on trochanters, femora, tibiae and tarsi) and metasoma (except yellow spots on T1-5, T1, S1, base of S2 and S8); S8 dark brown. Wing membranes hyaline, veins pale orange.

Distribution. Known only from near Granite Gorge, 12 km SW of Mareeba, North Queensland.

Remarks. The male of this species is readily distinguishable from other species of the genus by the absence of reddish orange colouration on the mesosoma (excluding the legs) although this is based only on a single specimen. It is also distinguished by the digiti which are not visible ventrally and the cuspis (Fig. 12) which has the ventral surface almost flat and sloping upwards towards apex, not abruptly truncated or concave apically. The female is unknown.

Etymology. The species name is derived from the Latin word *ebeneus* (= black) and refers to the relatively dark colour of the mesosoma.

***Nitidothynnus spinulus* sp. nov.**
(Figs 7, 9, 11, 13-15, 18-20, 23)

Type material. HOLOTYPE ♂ - NTM (I954): Virginia near Darwin, 12°33'S, 131°02'E, Northern Territory, 28 October 1996 S.M. Gregg. PARATYPES - *Northern Territory*: NTM (I955-I958) (3♂, 1♀), same data as holotype (1♂, 1♀ I955-I956), or dated 12 July 1997 (1♂ I957) or 16 November 1997 (1♂ I958); NTM, (I959-I962) (2♂, 2♀), Berrimah near Darwin, 1-15 November 1996 (1♂ I959), 16-30 November 1996 (1♂, 2♀ I960-I962), A. Salvarani; NTM (I963-I965), OTTAWA, WAM (26556) (5♂), Darwin, eucalypt woodland, Malaise trap, (site 93-86), 1-25 December 1993, S. and J. Peck; NTM (I966-I967), QM (T57842) (3♂), Anbangbang Billabong, Kakadu NP, 12°52'S, 132°48'S, 10 June 1996 (1 NTM I966). 17 January 1998 (1 NTM I967), 1 QM), G.R. Brown; ANIÇ, NTM (I968-I973), OTTAWA (8♂), Kapalga Research Stn, Kakadu NP, eucalypt woodland, Malaise trap, (site 93-117), 11-25 December 1993, S. and J. Peck; NTM (I974-I975), OTTAWA (3♂), Kapalga Research Stn, Kakadu NP, North Point Rainforest, Malaise trap, (93-134), 24 December 1993-7 January 1994, S. and J. Peck; NTM (I976) (1♂), Keep River National Park, Gurrandalng, 15°53'S, 129°03'E, 30 April 1996, G.R. Brown; NTM (I977) (1♂), Keep River National Park, Gurrandalng, 15°53'S, 129°03'E, 29 April 1996, G.R. Brown.

Other material. NTM (1♂), Keep River National Park, Gurrandalng, 15°53'S, 129°03'E, 29 April 1996, G.R. Brown.

Description of male. Body length 5-7 mm; fore wing 4-6 mm; hind wing 3-4 mm. Clypeus with apical margin width to maximum width 1:4.8. Anterior truncation of pronotum with ventral transverse carina broadly discontinuous medially. Fore and hind trochanters with ventral preapical spine. Genitalia as in Figure 15: apex of each basiparamere acute dorsoapically; parameres narrow and narrowly subtriangular; cuspis (Fig. 11) lamellate apically, ventral surface oblique. Otherwise as *N. purdiei*.

Colour. Similar to *Nitidothynnus purdiei* except that at most S2 has a pair of pale spots, the apex of S1 is reddish orange, and the basal three tarsomeres are yellowish ventrally and brown dorsally with the apical two tarsomeres uniformly dark brown.

Description of female. Body length 4 mm. Head (Fig. 20) rounded, slightly wider than long, sparsely punctate with semicircular closely punctate area on vertex, posterolateral angles strongly emarginate. T2 with 5 transverse carinae, apical 3 strongest, basal 2 may be obscured by T1. T3-5 with impressed curved preapical line preceded by a curved line of punctures. Pygidium (T6) with lateral margins parallel (Fig. 23).

Colour. Orangish-brown; coxae, trochanters, femora and mesosoma (except prothorax) slightly darker; tibiae and tarsi slightly paler.

Distribution. Top End of Northern Territory between Darwin and Kakadu National Park.

Remarks. This species is distinguished from all other species of *Nitidothynnus* by the presence of a preapical spine (most reliably viewed on the posterior surface) on the ventral margin of the fore and hind trochanters of the male. The female is distinguished by the structure of the head which has the posterolateral angles emarginate (Fig. 20) and T6 which is subparallel dorsally (Fig. 23). The only other known female in the genus, *N. purdiei*, has the posterolateral angles of the head rounded (Fig. 21) and T6 broadened ventroapically (Fig. 22).

Etymology. The species name is derived from the Latin word for a spine, and refers to the preapical spine on the fore and hind trochanters.

***Procerothynnus* gen. nov.**

Type species. Here designated *Procerothynnus centralianus* sp. nov.

Generic diagnosis. *Male.* Head, mesosoma and metasoma polished. Clypeus closely and finely punctate, sagittally carinate, narrowly produced, convex medially, convexity extending medially almost to apical margin of clypeus. Antennal prominence V-shaped, sagittally sulcate, not carinate, not strongly raised, at level of clypeus. Antenna very short, not reaching back to propodeum, flagellar segments only slightly longer than wide, apical six segments slightly arcuate. Maxillary palp segments 2-6 subequal, segments 4 and 6 slightly longer. Pronotum with lateral margins curved and convergent anteriorly, anterior margin sharply raised and subcarinate. Metasoma fusiform, segments 3-4 widest, segments wider than high. T2 depressed anteriorly, T3 at most

slightly depressed anteriorly. T7 convex becoming slightly produced and membranous apically, not carinate. S1 broadly medially raised. S8 rounded apically, without spines. Genitalia laterally compressed; basal ring short and predominantly membranous with narrow, sclerotized ring basally; basiparameres fusiform (viewed dorsally) with apical margin sinusoidal, strongly rounded (viewed laterally); paramere subtriangular to subquadrate; aedeagus long and narrow.

Remarks. *Procerothynnus* is distinguished from other genera of the generic cluster (and all other Australian Thynninae) by the combination of a medially convex clypeus that is sagittally carinate; very short antennae which do not reach back to the propodeum; S8 apically rounded and without spines; and the genitalia laterally compressed. A convex clypeus with a sagittal carina and S8 that is not apically spinose suggest a relationship with *Zeleboria*, *Psammothynnus* and *Chilothynnus*. However, the former two have the clypeus strongly convex and broadly produced and apically truncate. *Psammothynnus* also has S8 apically emarginate. *Chilothynnus* is the closest genus, but differs by having lateral spines on S8 (Brown 1997a), and together with all other Thynninae lack very short antennae and laterally compressed genitalia as found in *Procerothynnus*.

The three species placed in this genus are similar in appearance and are most reliably identified from the male genitalia. However, head colour appears reliable in distinguishing *P. arnhemicus* sp. nov. from other species of *Procerothynnus*. All are known from relatively few specimens from relatively few locations: *P. centralianus* sp. nov. from four locations in the East MacDonnell Ranges in central Australia; *P. arnhemicus* sp. nov. from near Oenpelli in western Arnhemland and *P. carpentarianus* sp. nov. from Musselbrook Reserve near the Northern Territory border in north-western Queensland. Like *Nitidothynnus*, nothing is know about the biology of *Procerothynnus*. All specimens were collected from habitats with loamy or sandy soil and near water courses (although all except the stream at Oenpelli, but including the stream at Musselbrook Reserve, were dry at the time at which specimens were collected).

Etymology. The generic name is masculine and is derived from the Latin word *procerus* which means tall and slender, and is a reference to the shape of the male genitalia which are relatively high (in profile) and slender (viewed dorsally).

Key to males of *Procerothynnus*. (Females are unknown.)

1. a Yellow marks above each antennal insertion at least partially confluent medially; mesoscutum above fore wing with at most a small yellow spot; genitalia with parameres broad and apex of basiparameres weakly sinusoidal (Figs 27, 29) .... *P. arnhemicus* sp. nov.

   b Antennal prominence with separate and discrete spot above each antennal insertion; mesoscutum with a longitudinal mark above fore wing; genitalia with parameres subtriangular and apex of basiparameres emarginate (Figs 25-7, 28) 2

2. a Punctures on propodeum relatively deep, discrete and distinct; genitalia as in Figure 25; apical margin of basiparameres weakly sinusoidal, slightly produced medially and apicolaterally .... *P. centralianus* sp. nov.

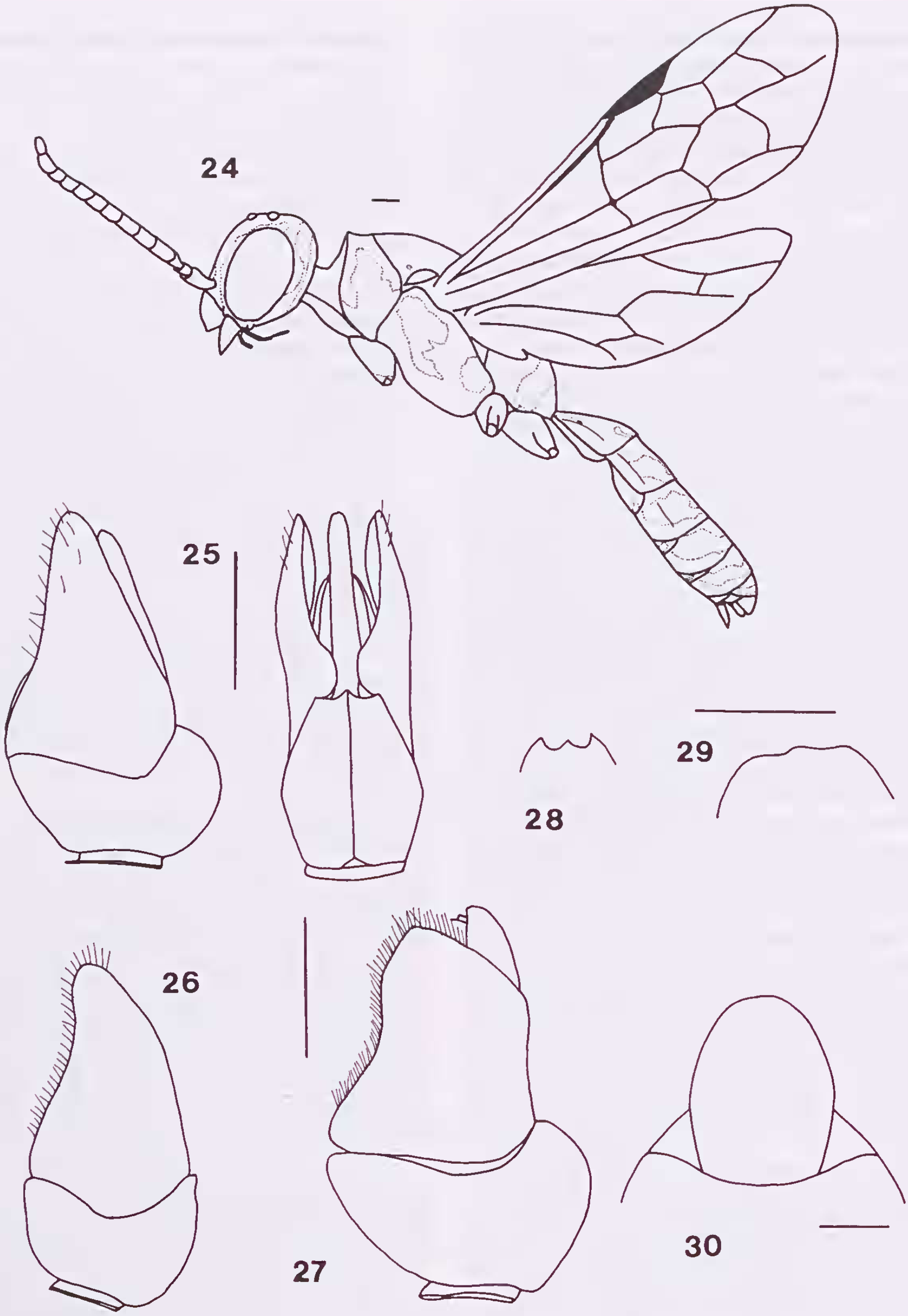
   b Punctures on propodeum shallow, often not discrete; genitalia as in Figures 26; apical margin of basiparameres (Fig. 28) strongly emarginate, produced medially and strongly produced apicolaterally .... *P. carpentarianus* sp. nov.

Procerothynnus centralianus sp. nov.
(Figs 25, 30)

Type material. HOLOTYPE ♂ - NTM (I979): near Ghost Gum, 23°32'S, 134°23'E, Trephina Gorge Nature Park, Northern Territory, 26 February 1997, G.R. Brown. PARATYPES - *Northern Territory*: NTM (I980) (1♂), Ross River Highway 23°38'S, 134°18'E, 6.2 km W of Trephina Gorge Nature Park, 1 March 1997, G.R. Brown; NTM (I981) (1♂), road to Ruby Gap Nature Park, 23°29'S, 134°54'E, 2 March 1997, G.R. Brown; NTM (I982) (1♂), Corroboree Rock Conservation Reserve, 23°41'S, 134°13'E, 1 March 1997, G.R. Brown.

Description of male. Body length 6.5-7 mm; fore wing 5-6 mm; hind wing 4-5 mm. Frons shallowly punctate to shallowly closely punctate, punctures becoming aligned longitudinally on antennal prominence. Clypeus with apical margin width to maximum width 1:4.2. POL:OOL 1:0.9. Vertex and gena shallowly rugosely punctate. Pronotum closely punctate. Mesoscutum punctate to sparsely punctate, closely punctate near anterior margin. Mesoscutellum and metanotum sparsely punctate. Propodeum closely to rugosely punctate, punctures discrete. Mesopleuron closely to rugosely punctate becoming. punctate ventrally. Fore coxae with ventral surface almost flat, subparallel basally, subtriangular apically. T1 width to length 1:1.0. Tergites almost impunctate, punctures shallow, transverse and slit-like on most segments, deeper and rounder on T6-7. T3 not depressed anteriorly. Sternites almost impunctate but with punctures aligned in transverse straight or curved lines, S8 closely punctate. Genitalia as in Figure 25; apical margin of basiparameres weakly sinusoidal, slightly produced medially and apicolaterally.

Colour. Black; yellow colouration as follows: clypeus (except medial anchor-shaped mark), mandibles (except apex), large spot above each antennal insertion, inner orbits continuous across vertex, outer orbits, margins of pronotum broadly confluent medially (except small central spot), tegulae, mesoscutum with curved mark



Figs 24-30. *Procerothynnus* spp., males: **24,** *P. arnhemicus* sp. nov., habitus; **25,** *P. centralianus* sp. nov., genitalia, lateral and dorsal; **26,** *P. carpentarianus* sp. nov., genitalia, lateral; **27,** *P. arnhemicus* sp. nov., genitalia, lateral; **28,** *P. carpentarianus* sp. nov., apical margin of basiparameres; **29,** *P. arnhemicus* sp. nov., apical margin of basiparameres; **30,** *P. centralianus* sp. nov., S8. Scale lines = 0.25 mm.

above fore wing and large medial subrectangular mark, mesoscutellum with large medial mark and smaller anterolateral spot, metanotum with disc, posterior margin narrowly and mark on anterior margin, metapleuron with large medial spot, broad sinusoidal transverse band on propodeum, three dorsal spots on mesopleuron, anterior spot largest, posterior spot near mid coxa smallest, coxae (except basally), apices of femora extending along ventral margin to base and along dorsal margin apically especially on fore leg, line on outer surface of tibiae, margins of mesosternal lamellae, lateral spot on T1-6 and S2-5 (smaller or inconspicuous on sternites) extending medially as a curved line near posterior margin of sclerites, posteromedial spot on S1; orange colouration as follows: apex of mandibles, lateral parts of anchor-shaped mark on clypeus, legs (except coxae and yellow marks); much of T1 apically, T2-3 and S2-3, reddish orange. Wing membranes hyaline, veins pale orange to brown.

Distribution. Eastern MacDonnell Ranges, Northern Territory.

Remarks. This species is distinguished from other species of *Procerothynnus* by the presence of relatively shallow punctures on the frons, a weakly developed clypeal carina, and the genitalia (Fig. 25) which have the apical margin of basiparameres weakly sinusoidal and slightly produced medially and apicolaterally.

Yellow colouration may be reduced such that marks and spots are smaller on some sclerites. In particular this colouration may be limited on the clypeus to the apical margin laterally, on the pronotum to the margins only, on the propodeum as lateral spots, on the tergites and sternites as a curved lateral line without a large lateral spot, and reduced on the legs especially the femora. The reddish orange colouration on the metasoma may be replaced with black as may some of the orange colouration on the legs. The Ruby Gap specimen is much darker than the other specimens but there is no noticeable difference in the genitalia.

Etymology. This specific name refers to the central Australian distribution of this species. It is intended to be construed as adjectival.

Procerothynnus arnhemicus sp. nov.

(Figs 24, 27, 29)

Type material. HOLOTYPE ♂ - NTM (I983): campsite near Oenpelli Reservoir, 12°23'S, 133°05'E, Oenpelli, Northern Territory, 27 November 1997, G.R. Brown and J.E. Purdie. PARATYPES - *Northern Territory*: ANIC , NTM (I984) (2♂), data as holotype; BMNH (E2000-27), NTM (I985-I986), WAM (26557) (3♂), Leaning Tree Lagoon, 12°43'S, 131°25'E, 11 December 1997, G.R. Brown and J.E. Purdie.

Other material. NTM (1♂), Leaning Tree Lagoon, 12°43'S, 131°25'E, 11 December 1997, G.R. Brown and J.E. Purdie.

Description of male. Body length 6 mm; fore wing 4.5 mm; hind wing 3.5 mm. Frons closely to rugosely punctate. Clypeus with apical margin width to maximum width 1:4.3. POL:OOL 1:1.2. Vertex and gena shallowly rugosely punctate, punctures more discrete on gena. Pronotum closely punctate becoming impunctate ventrally. Mesoscutum punctate, punctures sparser medially. Mesoscutellum and metanotum sparsely punctate. Propodeum closely to rugosely punctate, punctures discrete. Mesopleuron closely to rugosely punctate becoming sparely punctate ventrally. Fore coxae with ventral surface convex, subtriangular. T1 width to length 1:1.0. Tergites almost impunctate, punctures shallow, transverse and slit-like on most segments, deeper and rounder on T7 although punctures sparser medially. T3 at most slightly depressed anteriorly. Sternites almost impunctate, closely punctate on S8. Genitalia as in Figure 27; apical margin of basiparameres (Fig. 29) weakly sinusoidal, not produced apically.

Colour. As in *P. centralianus* except spots above antennal insertions partially confluent medially, mark above fore wing reduced to a small inconspicuous spot or absent, middle spot on mesopleuron small and posterior post absent, marks on most metasomal segments strongly curved, and metasoma without reddish orange colouration. Wing veins generally paler except subcosta.

Distribution. Known only from the vicinity of Kakadu National Park, Northern Territory.

Remarks. This species is readily distinguished from other species of *Procerothynnus* by having separate yellow spots above each antennal insertion, at most a small yellow spot on the mesoscutum immediately above the base of the fore wing, and the structure of the genitalia (Fig. 27), which have the apical margin of basiparameres (Fig. 29) weakly sinusoidal and not produced apically.

Etymology. This specific name is derived from the type locality. It is intended to be construed as adjectival.

Procerothynnus carpentarianus sp. nov.

(Figs 26, 28)

Type material. HOLOTYPE ♂ - UQIC: Murrays Spring, 18°35'15"S, 138°04'28"E, 7km W of Musselbrook Resource Center, Lawn Hill National Park, Queensland, 200 m, 10 May 1995, G. Daniels, M.A. Schneider. PARATYPES - *Queensland*: UQIC (1♂), data as holotype dated 4 May 1995.

Description of male. Body length 6 mm; fore wing 4.5 mm; hind wing 3.5 mm. Frons shallowly rugosely punctate. Clypeus with apical margin width to maximum width 1:4.0. POL:OOL 1:1.2. Vertex and gena shallowly punctate. Pronotum punctate becoming longitudinally rugulose ventrally. Mesoscutum punctate. Mesoscutellum and metanotum sparsely punctate.

Propodeum closely to rugosely punctate, punctures shallow and not always discrete. Mesopleuron punctate. Fore coxae with ventral surface almost flat, subtriangular. T1 width to length 1:1.5. Tergites almost impunctate, punctures shallow, transverse and slit-like on most segments, deeper and rounder on T6-7 although punctures sparser medially. T3 not depressed anteriorly. Sternites almost impunctate, S1 and S8 closely punctate. Genitalia as in Figure 26; apical margin of basiparameres (Fig. 28) strongly emarginate, produced medially and strongly produced apicolaterally.

Colour. As in *P. centralianus* except middle spot on mesopleuron small and posterior spot absent, yellow marks on sternites mostly absent, and metasomal segment 3 is darker with less reddish orange. Wing veins generally paler except subcosta.

Distribution. Known only from two specimens from Musselbrook Reserve north-western Queensland on the border of the Northern Territory.

Remarks. This species is easily distinguished from the other two species of the genus by shallower and less discrete punctures on propodeum, and the structure of the genitalia (Fig. 26), which have the apical margin of basiparameres strongly emarginate and produced medially and strongly produced apicolaterally (Fig. 28).

Etymology. This specific name is derived from The Gulf of Carpentaria which is the broader Australian region from which the types were collected. It is intended to be construed as adjectival.

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